eRD6 Tracking Simulation in Fun4All And EicRoot MPGD Study

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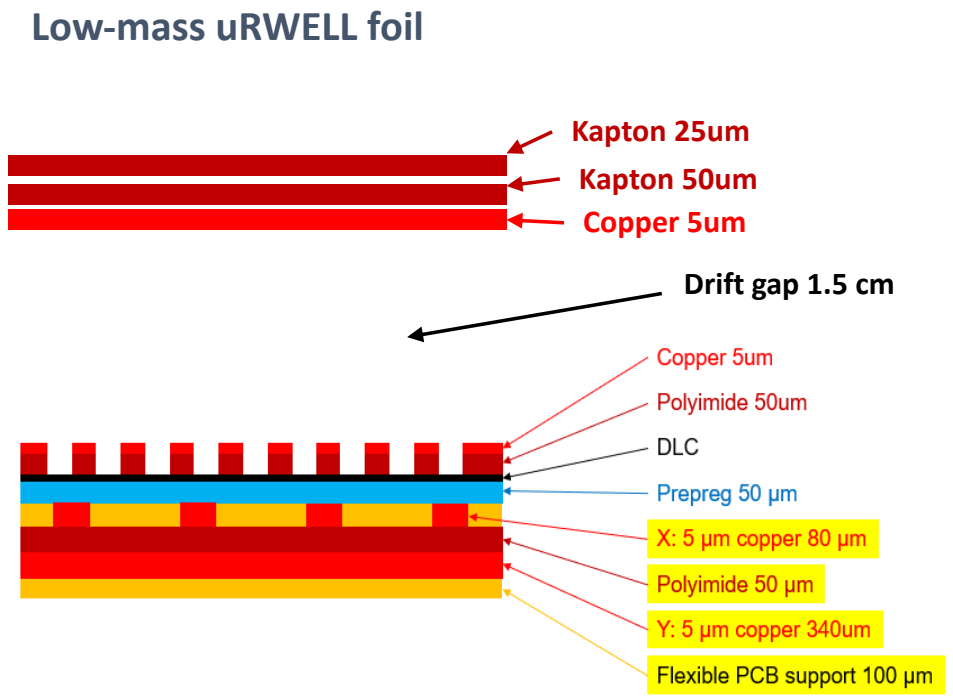
Cylindrical $\mu RWell$ Geometry

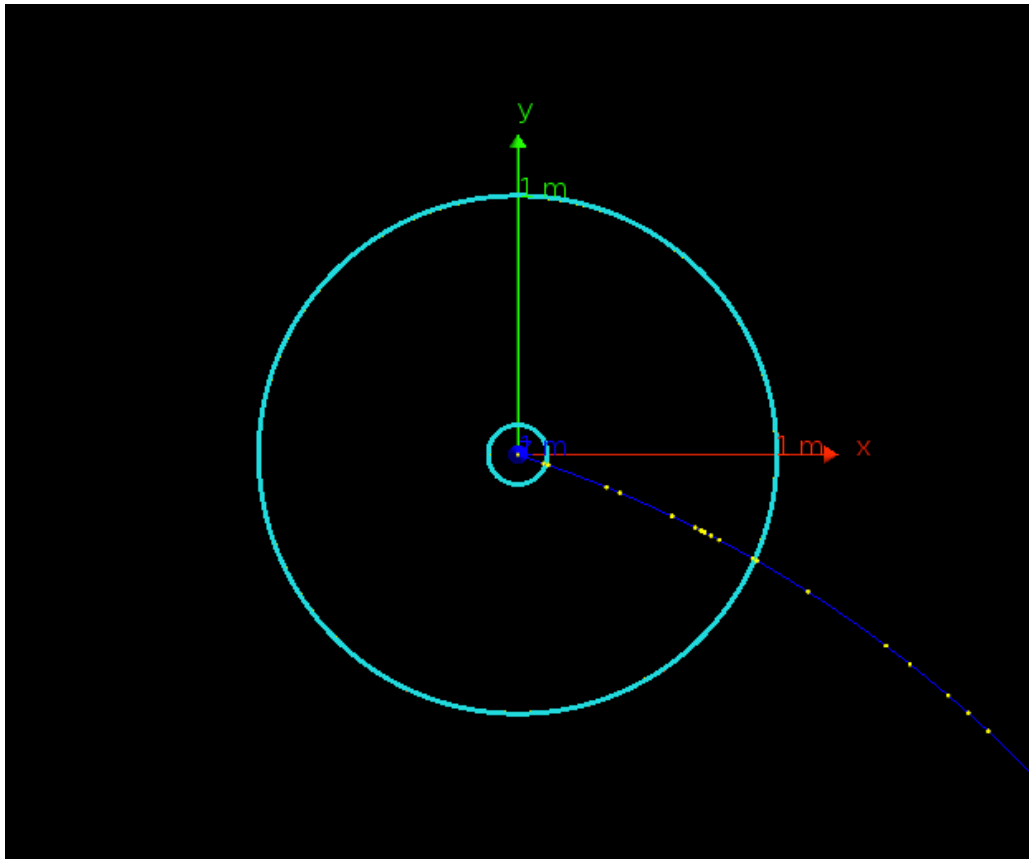
$\mu RWELL$ Geometry implementation in Fun4ALL

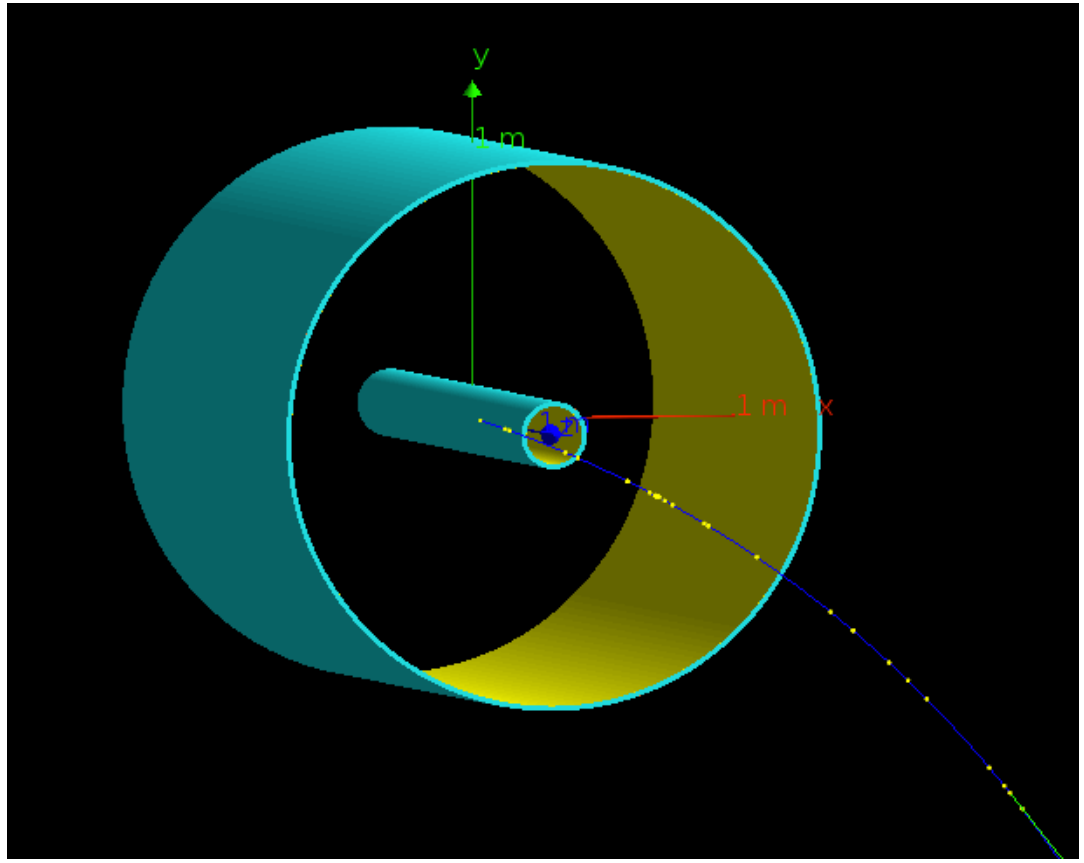
- Modified Fun4All Silicon cylinder tutorial macro to describe a $\mu RWELL$
- Material summary
  - Total Cu = $20\ \mu m$
  - Total Kapton = $175\ \mu m$
  - DLC layer – not included
  - Prepreg – modeled as NOMEX
  - PCB -- modeled as FR4
  - Drift gap – modeled as Ar (for now)
- Geometry
  - 2 cylinders (Before and after TPC location)
  - Inner radii = 8.5 cm and 80 cm
  - Total thickness = 1.53 cm
  - Length = 200 cm



Cylindrical $\mu RWell$ Geometry

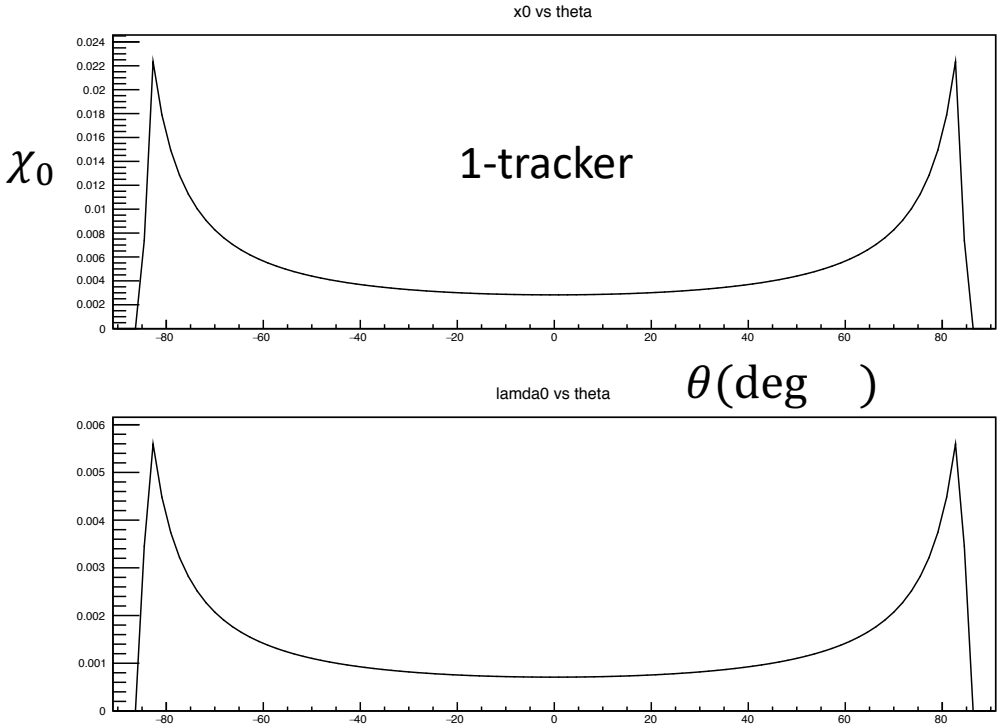
- $\mu RWELL$ Geometry implementation in Fun4ALL

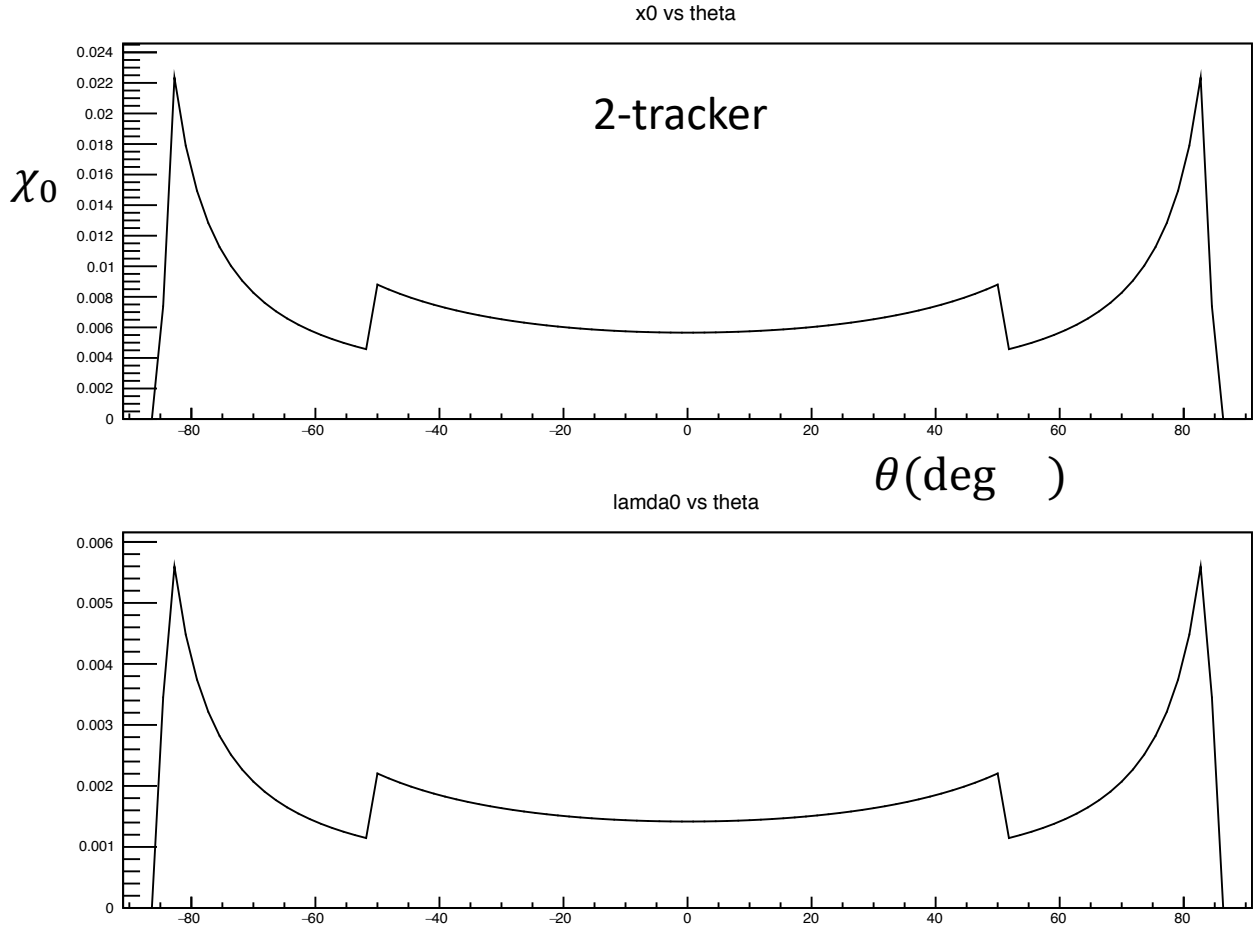




Cylindrical $\mu RWell$ Geometry Material Scan

- Material scan macro is available in Fun4All
  - 2 cylindrical $\mu RWell$ trackers
  - $\theta = 0 \Rightarrow$ perp. (up) To beam direction



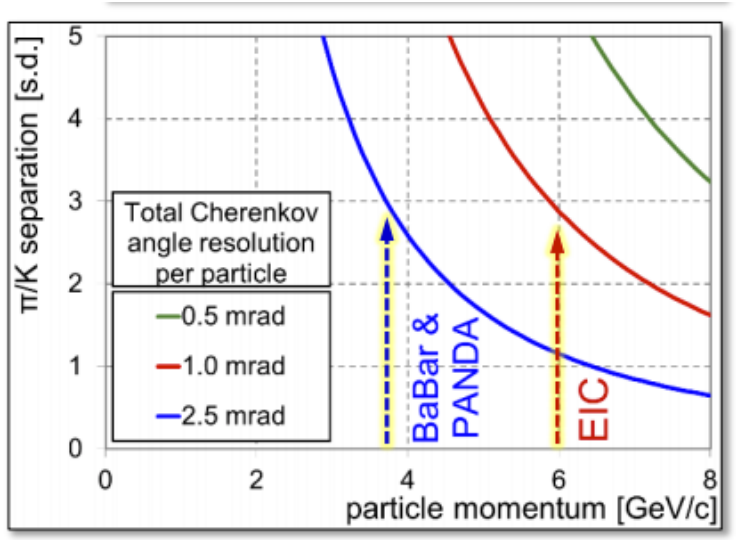


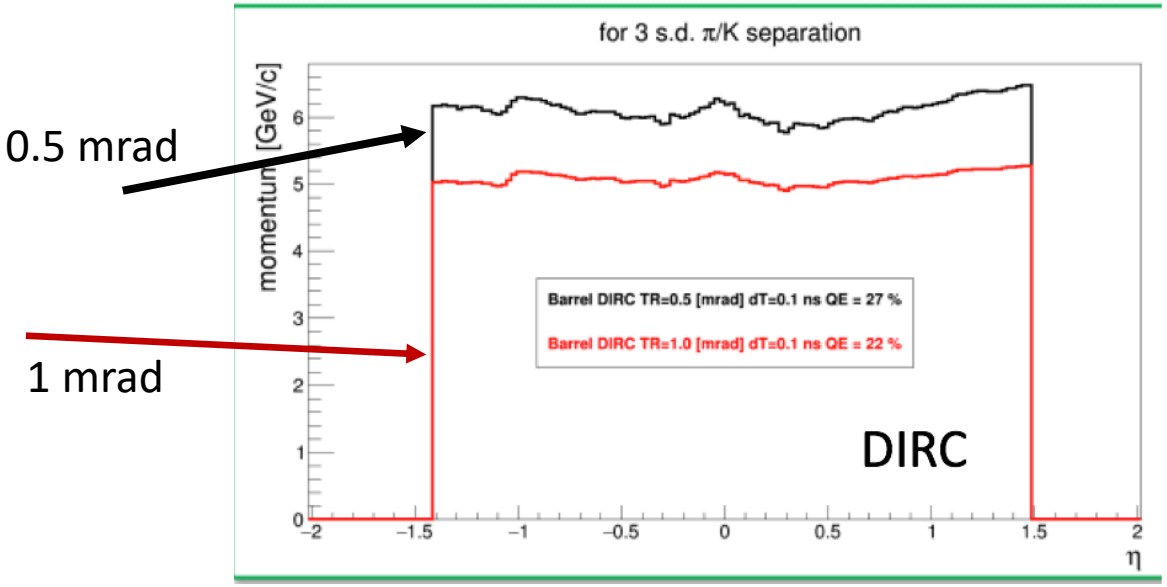
Need for Precision Tracking at EIC

- Tracking requirements at EIC
  - Handbook: Central momentum resolution

$$0.05\% \times p + 0.5\%$$

  - DIRC performance depends on angular precision of reconstructed track
    - Extend momentum reach to ~ 6 GeV @ 3σ π/K
  - Advantages of MPGDs
    - Fast trackers for base barrel detector (TPC, silicon,…)
    - Provide additional information for DIRC reconstruction
      - Operating in μTPC mode allows tracklet reconstruction
    - Low material



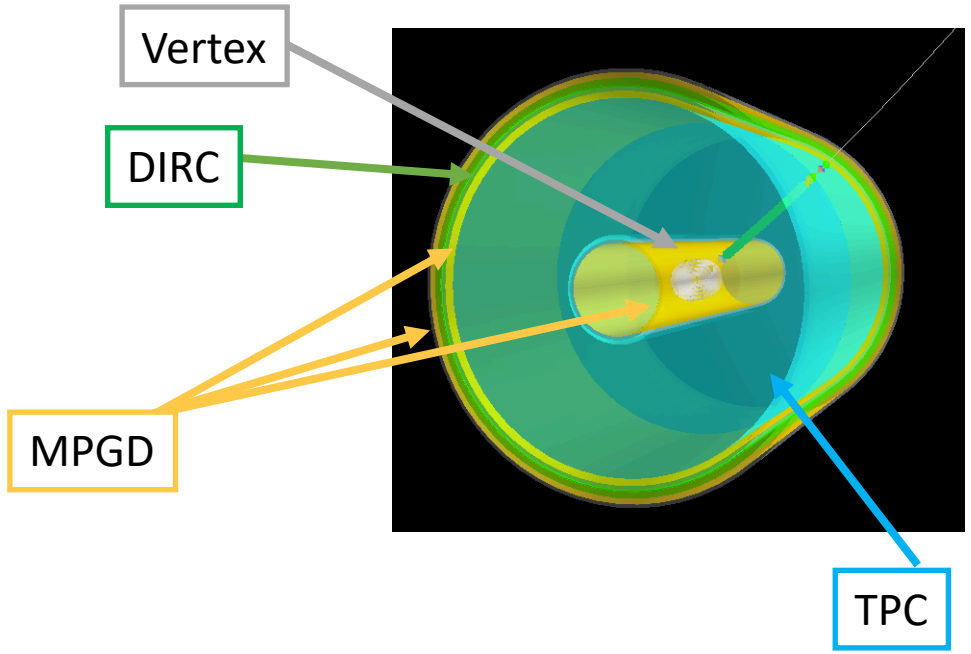


Simulation Setup

- Goals
  - Investigate impact of MPGD layers on track reconstruction
    - Angular and momentum reconstruction
  - Compare tracking performances in 1.5 T and 3.0 T magnetic fields

- Simulation Setup
  - EicRoot (started from Nick's code…Thanks!)
  - Setup 1
    - Vertex, TPC, 3 MPGD layers, DIRC (material)
    - MPGD layers looked at with 1 and 5 hits each
  - Setup 2
    - Vertex, TPC, DIRC (material)

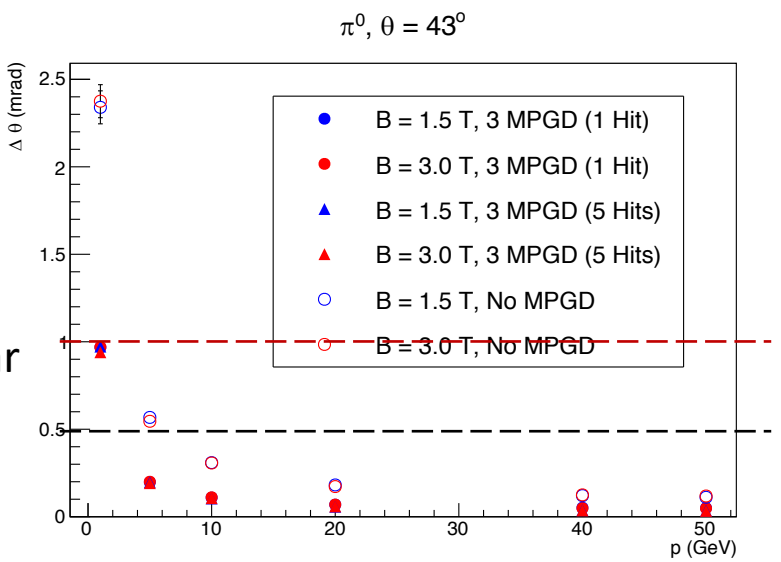
Simulation Setup 1

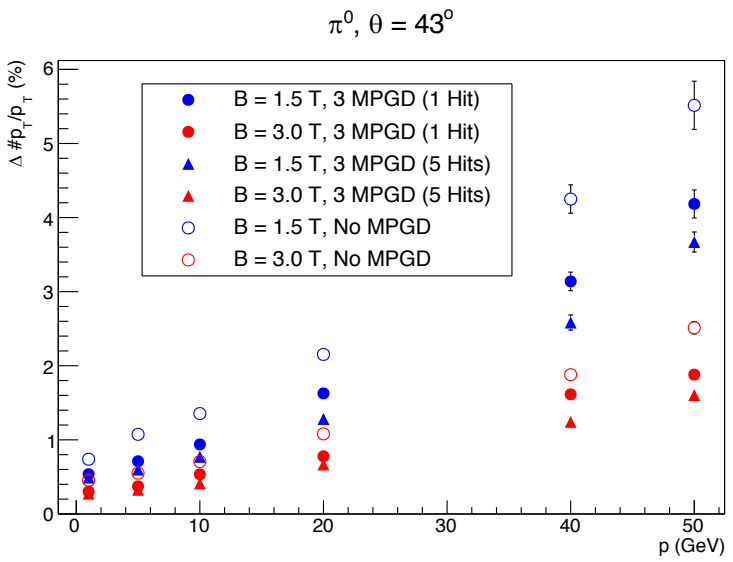


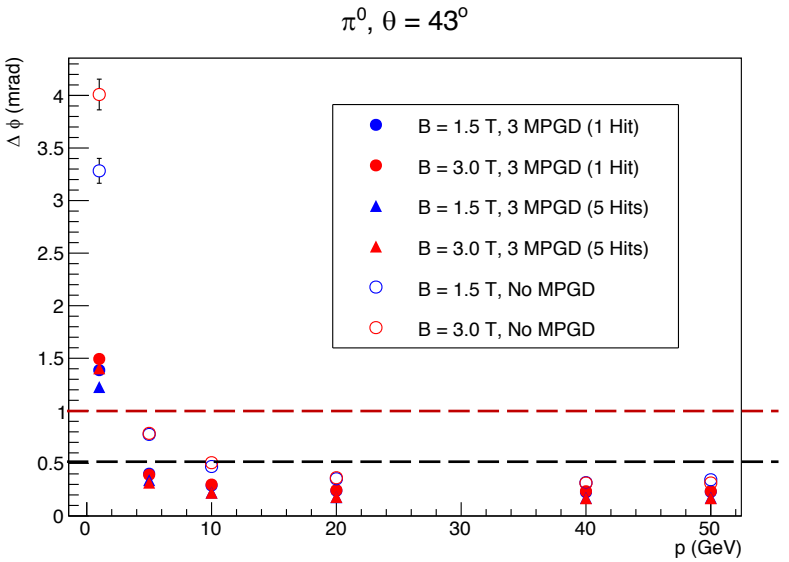
Tracking Results $\theta = 43^o$

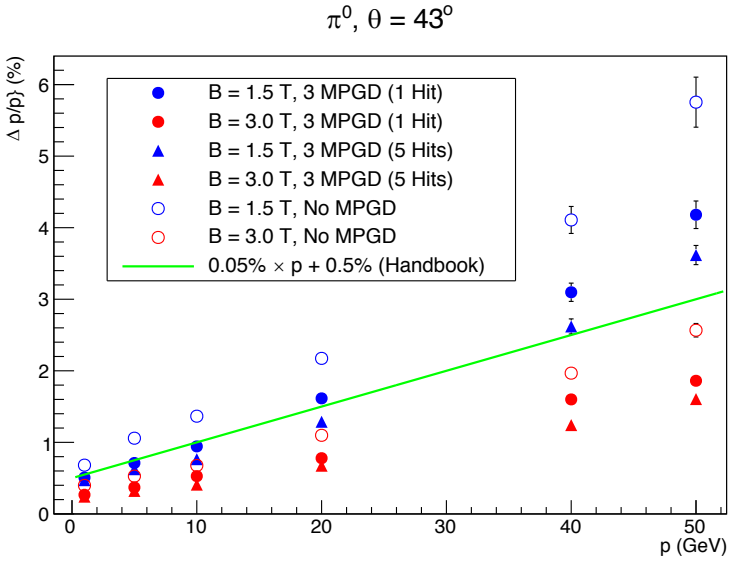
❑ $\theta = 43^0, \eta = 0.93$

- Additional tracking is needed at low momentum ~< 5GeV to bring angular resolution to ~0.5-1 mrad. → MPGD layers
- B-Field has small impact on angular resolution
- Larger B-field needed to maintain handbook momentum resolution value at high momentum.





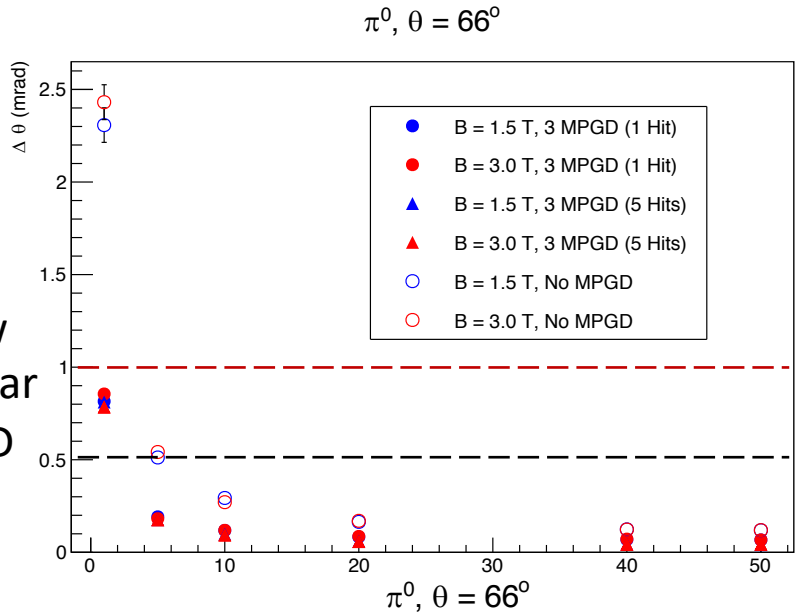


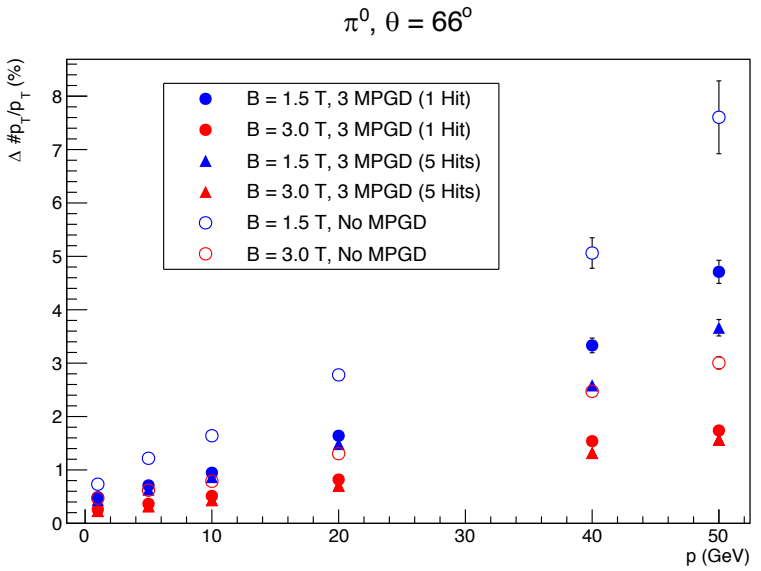


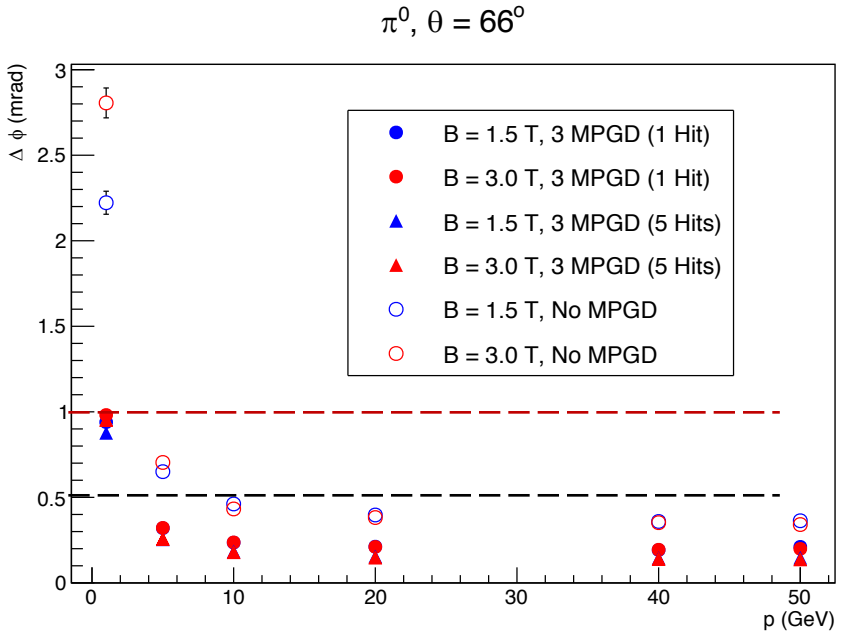
Tracking Results $\theta = 66^o$

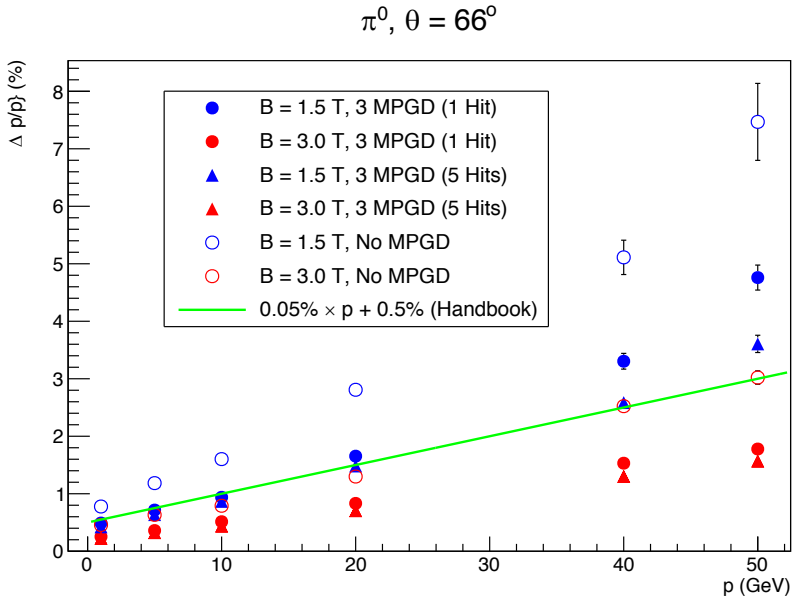
- $\theta = 66^0, \eta = 0.43$

- Additional tracking is needed at low momentum ~< 5GeV to bring angular resolution to ~0.5-1 mrad. → MPGD layers
- B-Field has small impact on angular resolution
- Larger B-field needed to maintain handbook momentum resolution value at high momentum.









Tracking Results $\theta = 89^o$

- $\theta = 89^0, \eta = 0.02$

- Additional tracking is needed at low momentum ~< 5GeV to bring angular resolution to ~0.5-1 mrad. → MPGD layers
- B-Field has small impact on angular resolution
- Larger B-field needed to maintain handbook momentum resolution value at high momentum.